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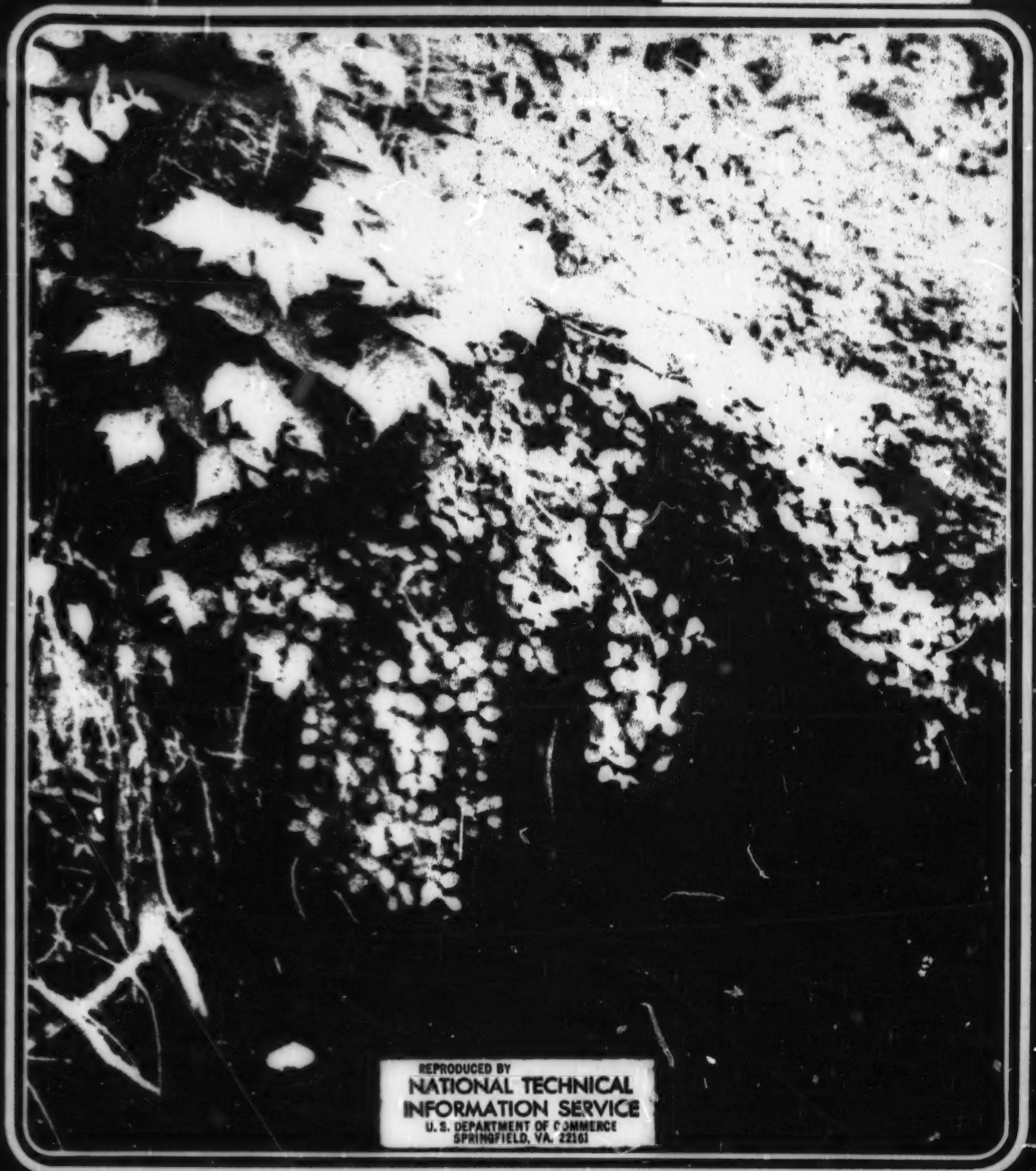

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# ENVIRONMENTAL QUALITY PROFILE 1976
## technical supplement

# IDAHO

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16. ABSTRACT

This report is a technical supplement to the 1976 REGIONAL ENVIRONMENTAL QUALITY PROFILE (EPA REGION X) and is designed to inform the reader about the general status of the environment within the state of Idaho. It is designed to report on the present status of Idaho air and water quality, trends in that quality, an analysis of the causes and effects of observed pollution problems and EPA's view of the near term outlook for solving these problems.

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SUPPLEMENT

1976 ENVIRONMENTAL QUALITY PROFILE

FOR IDAHO

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# 1976 ENVIRONMENTAL QUALITY PROFILE SUPPLEMENT FOR IDAHO

## INTRODUCTION

State, federal, and local environmental quality control agencies maintain monitoring networks to scientifically measure the quality of our environment. These monitoring networks are invaluable in determining where pollution problems exist and to measure the success or failure of abatement and pollution prevention programs.

The Seattle Regional Office of the Environmental Protection Agency annually evaluates all data collected by northwest pollution control agencies and submitted to the EPA computer data storage systems. We feel the public should be made aware of the results of these evaluations. This document and similar future documents are designed to report on the present status of northwest air and water quality, trends in that quality, an analysis of the causes and effects of observed pollution problems and our view of the near term outlook for solving these problems. This report is a technical supplement to the 1976 Regional Environmental Quality Profile and is designed to inform the reader about the general status of the environment within the state.

The reader may find a few inconsistencies between this supplement and the 1976 Regional Environmental Quality Profile due to the continual profile upgrading process which includes improvement of evaluation and presentation techniques. These changes are the result of our readers comments and suggestions. Formulating useful and accurate indices of environmental quality is a difficult task. Additional suggestions for improving the information presented in this document would be appreciated. Please direct your comments to the Office of the Regional Administrator, U. S. Environmental Protection Agency, 1200 Sixth Avenue, Seattle, Washington 98101.

## REGIONAL AIR QUALITY PROFILE

### OVERVIEW

Air pollution--as pollutant concentrations in excess of those established by National health-related air quality standards--occurs in every State in Federal Administrative Region X. Standards for four of the most widespread pollutants were exceeded in the State of Washington for the three year period ending in 1974. Alaska and Idaho exceeded standards for two of the four. Three standards were exceeded in Oregon. Frequency of excessive pollutant concentrations, as measured by number of violation-days, was greatest in sparsely populated Idaho, least in Oregon. (A violation-day, for the purposes of this report, was established whenever a standard was exceeded in a county.) More serious "alert level" pollutant concentrations were recorded most often in Alaska, least often in Oregon.

TABLE 1 - REGION X STATES

| | Concentrations Exceeding Standard | | | | Violation-Days | |
|---|---|---|---|---|---|---|
| | Carbon Monoxide | Photo Oxidants | Particulate Matter | Sulfur Dioxide | Standard Exceeded | Alert Level |
| Alaska | X | | X | | 412 | 174 |
| Idaho | | | X | X | 446 | 149 |
| Oregon | X | X | X | | 301 | 40 |
| Washington | X | X | X | X | 368 | 48 |

Excessive pollutant levels were concentrated in nine Region X communities that together accounted for 72 percent of all violation-days and 74 percent of all alert level violation-days. The core cities of the Region's seven standard metropolitan statistical areas were responsible for just under half of all violation-days and just under two-fifths of all alert level violation-days. But two fairly small communities, Fairbanks, Alaska and Kellogg-Wallace, Idaho, exceeded any of the larger cities in numbers of times excessive pollutant concentrations were recorded, and were responsible for almost half of all recorded pollutant concentrations above the alert level.

TABLE 2 - PRINCIPAL CITIES

| | Concentrations Exceeding Standard | | | | Violation-Days | |
|---|---|---|---|---|---|---|
| | Carbon Monoxide | Photo Oxidants | Particulate Matter | Sulfur Dioxide | Standard Exceeded | Alert Level |
| Seattle | X | X | X | | 149 | 16 |
| Portland | X | X | X | | 165 | 30 |
| Spokane | X | | X | | 82 | 3 |
| Tacoma | X | X | X | | 43 | 5 |
| Anchorage | X | | X | | 142 | 90 |
| Boise | | | X | | 11 | 6 |
| Eugene | X | X | X | | 56 | 2 |
| Salem | X | X | | | 23 | 1 |
| Fairbanks | X | | X | | 203 | 73 |
| Kellogg-Wallace | | | X | X | 217 | 69 |



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A great deal of Region X's air pollution can be attributed to the automobile. Just under half of Alaska's violation-days can be traced to the automobile and the bulk of Oregon's and Washington's problems (in violation-days) can be traced to the automobile. The bulk of Oregon's and Washington's standards violation problems were due to carbon monoxide and photochemical oxidant concentrations that occurred around the largest cities of the two States. Those pollutants could be traced almost entirely (i.e., 80 to 90 percent) to automobile exhausts. Because well over half of the Region's population lives in and around the six cities in which such pollution occurs, population exposure to risk as a consequence of automobile emissions is a significant public health problem of the Pacific Northwest and Alaska.

TABLE 3 - AUTO-RELATED VIOLATION DAYS

| | |
|---|---|
| Alaska | 42.2% |
| Anchorage | 16.9% |
| Fairbanks | 77.8% |
| Idaho | No Data |
| Oregon | 85.0% |
| Portland | 97.6% |
| Eugene | 85.7% |
| Salem | 100.0% |
| Washington | 66.8% |
| Seattle | 99.3% |
| Spokane | 82.9% |
| Tacoma | 46.5% |
| Region X | 45.1% |

# AIR QUALITY IN IDAHO

Under the Clean Air Act of 1970, the Environmental Protection Agency has established National standards that specify maximum permissable levels of pollutant materials in air.

Standards for the principal and most widespread pollutants--total suspended particulate matter, sulfur dioxide, carbon monoxide, photochemical oxidants, and oxides of nitrogen--are divided into two categories. Primary standards are set at levels intended to protect human health. Secondary standards are set at levels intended to protect against other forms of damage caused by air pollution.

The material that follows is an attempt to describe simply what is known about air quality in the State of Idaho in terms of its adherence to National primary air quality standards. Those standards have been established to protect against the following specific health effects that have been demonstrated to stem from the particular pollutant:

Total suspended particulates--aggravation of asthma and chronic lung diseases, increased cough, chest discomfort, restricted activity, aggravation of heart and lung disease symptoms in the elderly, increased death rate;

Sulfur dioxide--aggravation of asthma, aggravation of heart and lung disease symptoms in the elderly, increased lung illness, increased death rate;

Carbon monoxide--interference with mental and physical activity, reduced capacity in persons suffering from heart and other circulatory disorders;

Photochemical oxidants--aggravation of asthma and chronic lung disease, irritation of the eye and of the respiratory tract, decreased vision, reduced heart and lung capacity;

Oxides of nitrogen--increased chronic bronchitis.

The material is presented in graphic form. It is intended to depict:

1) where, and how often, primary standards were exceeded in 1974,

2) location and frequency of severe concentrations of health damaging pollutants in 1974,

3) indicated trend of pollutant concentrations in the period 1972 to 1974, and

4) sources of the principal pollutants found to be in excess of the primary standard in 1974.

## POLLUTANTS IN EXCESS OF HEALTH STANDARDS

During the three year period ending in 1974, ten of Idaho's forty-four counties experienced recorded concentration of pollutants that exceeded the allowable maxima specified by primary air quality standards. The counties are ranked in the chart (Figure 1) according to the average number of days per year in which a standard was exceeded.

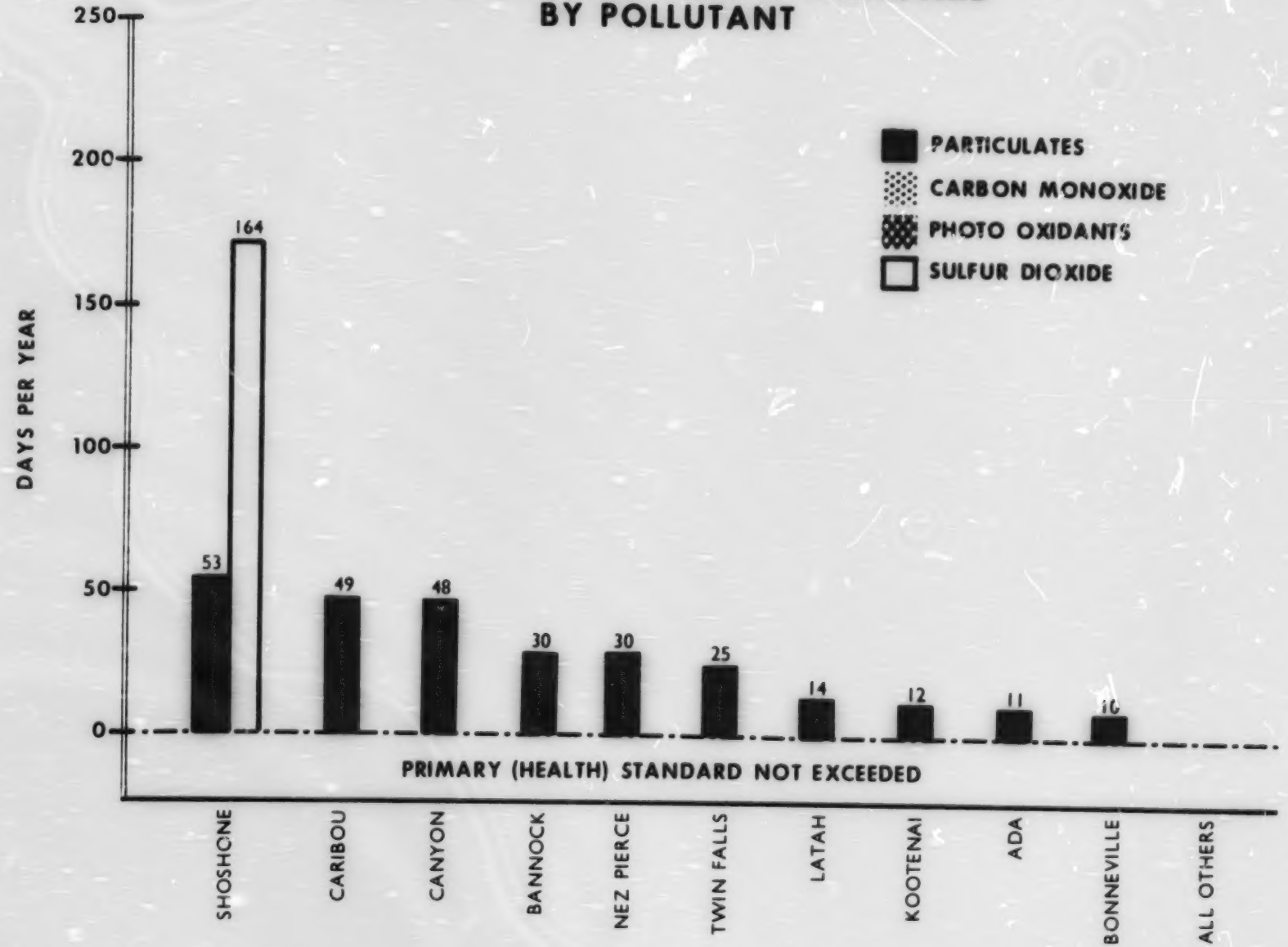
Standards for two pollutants were not met. Particulate matter (gray bar) was the most widespread cause of an exceeded standard. Concentrations above the primary standard occurred in every county in which the standards were not met.

The sulfur dioxide standard was exceeded only in Shoshone County, where it was not met on 164 days--approximately 45% of the entire year.

Shoshone County, with it's 217 violation-days for particulates and sulfur dioxide, constituted 77% of the State of Idaho's violation-days and 20% of all violation-days in the three State area.

Figure 1

# IDAHO
## DAYS EXCEEDING HEALTH STANDARD BY POLLUTANT



## SEVERITY OF POLLUTION

Primary air quality standards include three degrees of risk, according to level of pollutant concentrations. The nature of potential health damage is the same at each level, but the probability of damage and the proportion of the population that is predisposed to health impairment increases as the amount of pollutants in air increases. There are distinct thresholds that indicate the degree of risk that is believed to be associated with certain pollutant concentrations, and these are recognized in the primary air quality standards. As the higher concentrations occur, the enhanced danger of the consequent pollution is designated by an air quality standard category. "Alert" level pollutant concentrations are thought to be significantly more serious than lower concentrations exceeding the primary standard. "Warning" levels are thought to be significantly more serious than alert.

TABLE 4

Threshold Pollutant Concentrations (per cubic meter of air)

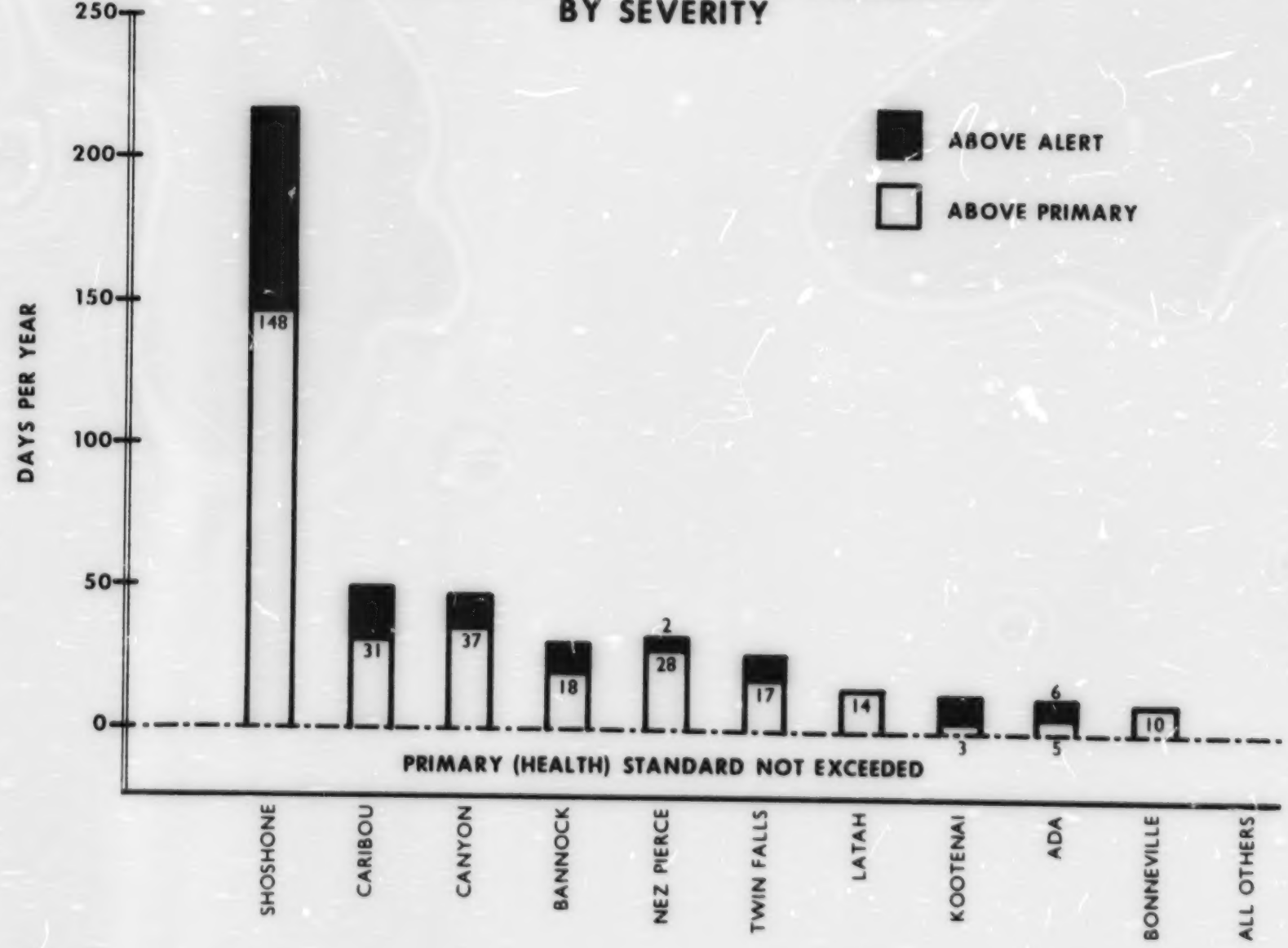
| Pollutant | Standard | Alert | Warning |
|---|---|---|---|
| Particulates (24 hour) | 260 micrograms | 375 | 625 |
| Sulfur dioxide (24 hour) | 365 micrograms | 800 | 1,600 |
| Carbon monoxide (8 hour) | 10 milligrams | 17 | 34 |
| Oxidants (1 hour) | 160 micrograms | 200 | 800 |

In 1974 (Figure 2), at least 149 of the 446 instances in which health standards were exceeded in Idaho involved concentrations at or above the alert level. Almost half of those more serious conditions occurred in Shoshone County's mining-smelting area.

Figure 2

# IDAHO

## DAYS EXCEEDING HEALTH STANDARD BY SEVERITY



## POLLUTANT SOURCES

The graph in Figure 3 below indicates the estimated distribution of particulate matter emissions by source in those Idaho counties in which a primary air quality standard was exceeded in 1974. Substantially all sulfur dioxide emanated from a single complex of point sources.

Such point sources--large, recognizable features such as factories--accounted for the bulk of particulate production in the State, as well as in all but two of the total counties in which particulate standards were exceeded. In total, point source particulate emissions amounted to about 18,000 tons of the more than 24,000 tons of particulate matter produced in 1974.

Area sources--space heating, transportation devices, brush and field burning, wind blown dust: the variety of small, intermittent sources of pollutants too numerous and insignificant in themselves to be cataloged --though in combination they may generate large volumes of pollutants--were responsible for less than 6,000 tons of particulate matter.

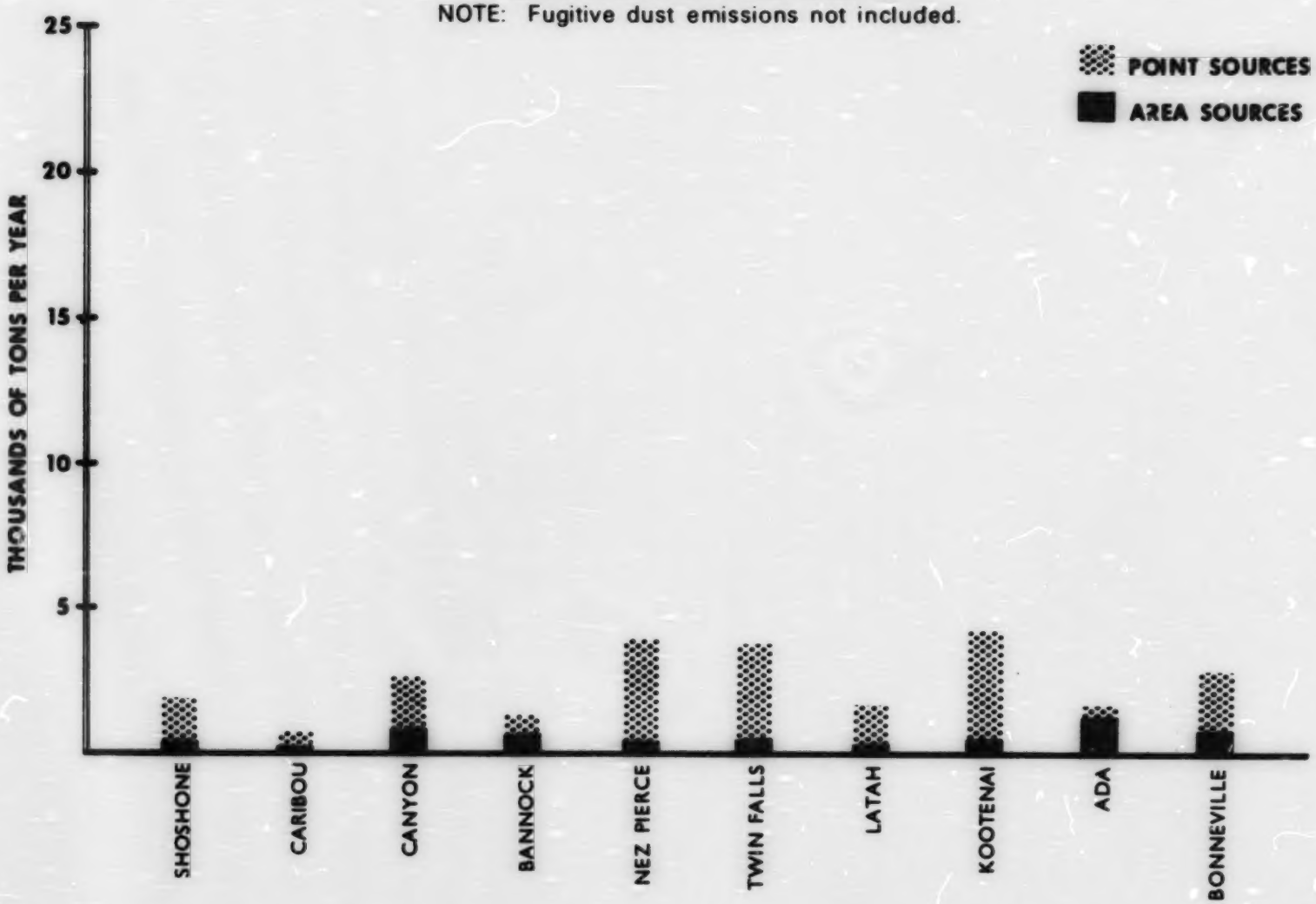
A comparison of the volume of particulate emissions with frequency of violation days does not result in a direct correlation without including the enormous influence of weather on the occurrence of air pollution.

Figure 3

# IDAHO

## POINT AND AREA SOURCE PARTICULATE EMISSIONS

NOTE: Fugitive dust emissions not included.



## AIR POLLUTION TRENDS

The chart in Figure 4 shows indicated trends of pollutant concentrations in Idaho counties, as those trends may be derived from the air monitoring record for the period 1972 through 1974.

Blue boxes indicate that there is no evidence that the specified air quality standard has been exceeded. Where circles occur within the box, the presumed compliance with standards is not based on measurements, but is derived from judgment and a knowledge of pollutant sources.

Yellow boxes indicate that a standard has been exceeded, without concentrations reaching the alert level. An upward pointing arrow indicates that measured concentrations of the specified pollutant appear to be increasing--that the propensity for pollution to occur is rising. A downward pointing arrow indicates that concentrations appear to be receding.

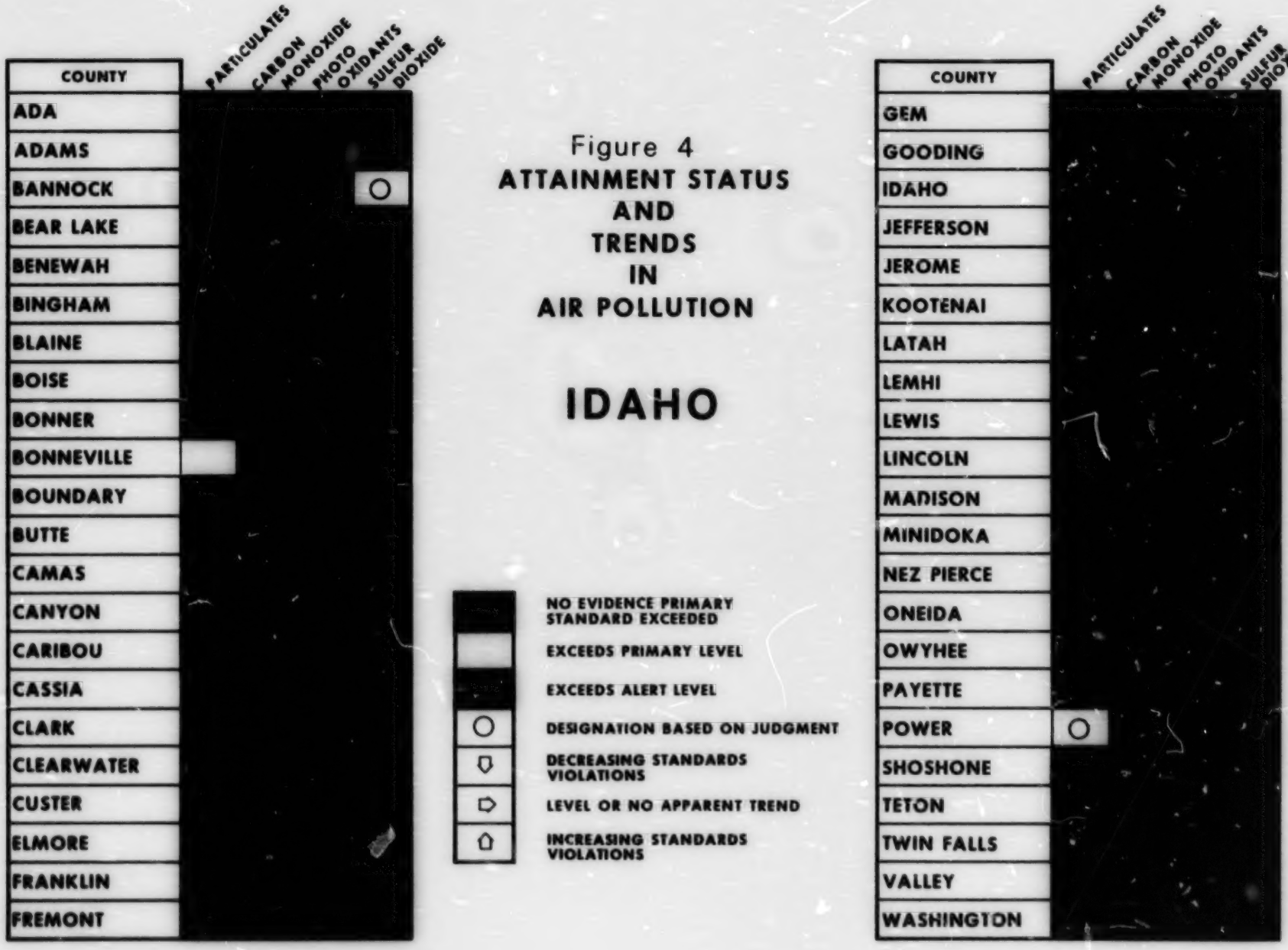
Red boxes are used where a pollutant concentration has exceeded the alert level. Again, the arrow within the box indicates the apparent direction of the pollutant's concentration.

On balance, there seems to have been some deterioration in Idaho's air quality conditions between 1972 and 1974. Particulate concentrations appear to be rising in most of the counties in which the health standard for particulate matter has been exceeded. More serious, the severe pollution by sulfur dioxide in Shoshone County does not appear to be improving. It should be noted, however, that fluctuating meteorological conditions make it unwise to draw more than tentative conclusions about air quality trends on the basis of a period as short as three years.

Figure 4

# ATTAINMENT STATUS AND TRENDS IN AIR POLLUTION

# IDAHO



## NEAR TERM OUTLOOK

With the very significant exception of the severe pollution in the Kellogg-Wallace area and intermittent particulate concentrations in excess of air quality standards through much of southern Idaho, the State's air quality is excellent. Though existing trends are unfavorable on balance, there is little in a review of the kinds, frequencies, and sources of pollutant concentrations that exceed the standard to indicate a turn for the worse. Unfortunately, neither are prospects for major improvement particularly bright.

Particulates, the most common form of pollutants in excess of standards, would appear to offer some opportunities for relief. Point sources of particulates predominate; and the combination of source identification with the availability of reliable, relatively inexpensive control technology indicates that abatement of pollutional conditions is possible. It would appear that the lesser share of total particulates represented by area sources is often catalyzed into pollutional levels by meteorological conditions. Natural and wind blown dust is probably responsible for a much larger share of Idaho's air pollution by particulates than the gross volume of area source particulates would indicate; so, even though control of point sources may reduce the frequency or severity of particulate standard problems, they must be expected to continue to occur.

Sulfur dioxide control prospects are also limited by natural conditions; and these are complicated by institutional difficulties. Control techniques are available to effect significant additional reductions in the volume of pollutant emissions; but the cost of such controls and technical controversy over choice among the several alternative control strategies may result in continuation of the protracted negotiation and litigation that have postponed remedial action. And though controls can achieve a major reduction in amount of sulfur dioxide emissions, the winter inversions of the narrow Coeur d'Alene River Valley are likely to cause continuing difficulty in meeting standards. Unquestionably, there can be meaningful reductions in the frequency, duration, and intensity of pollutant excursions beyond the standard; the feasibility of total elimination of air pollution remains to be demonstrated.

## REGIONAL WATER QUALITY PROFILE

### OVERVIEW

Relative pollution of the non-marine waters of major Pacific Northwest rivers is indicated on the accompanying graphs. Figure 5 depicts the degree of pollution in each major regional river reach and Figure 6 shows the location of the river reaches. Similar determinations are not available for Alaskan waters due to a lack of necessary data. EPA and the State of Alaska are currently working together toward the development of a water quality monitoring program that will provide the same depth of information that is available in other Region X states.

The basis of comparison between waters of the Pacific Northwest is an eleven part Water Quality Index (WQI) that compares measured water quality conditions during the last five years with federal criteria recommended by the National Academy of Sciences.[1/] Approximately four hundred (400) water quality stations located on a majority of the streams throughout the three Northwest states were used in the evaluation. Measured water quality constituents from various federal, state and local agencies are stored in EPA's data storage and retrieval system called STORET. The federal water quality criteria are recommended threshold concentrations in water which are considered suitable for propagation of fish, the use by wildlife, and for recreation. The eleven criteria groups considered in the index are listed in Table 5.

The index number for any river segment is calculated by multiplying the frequency of criteria violations for each constituent by a severity weighting function which is based on the magnitude of violation. Individual river segment index numbers are multiplied by a ratio of segment river miles to total river miles, then summed to obtain average WQI for the total river. The WQI number spans a scale that may run from 0.0 (no measured evidence of pollution) to 110.0 (severe pollution in all criteria groups at all times); however, most Pacific Northwest streams fall into a category below the scale of 20.0. General, federal criteria were employed for the particular index construction rather than the specific state water quality standards that apply to the various waterbodies. State water quality standards reflect local natural conditions whereas federal criteria are based upon field and laboratory studies which have been shown nationally to correlate with biological, recreational, and health problems. Federal criteria are in some cases more stringent than state standards. Index values computed from federal criteria will therefore tend to present a more conservative estimate of water quality than if actual state standards were applied.

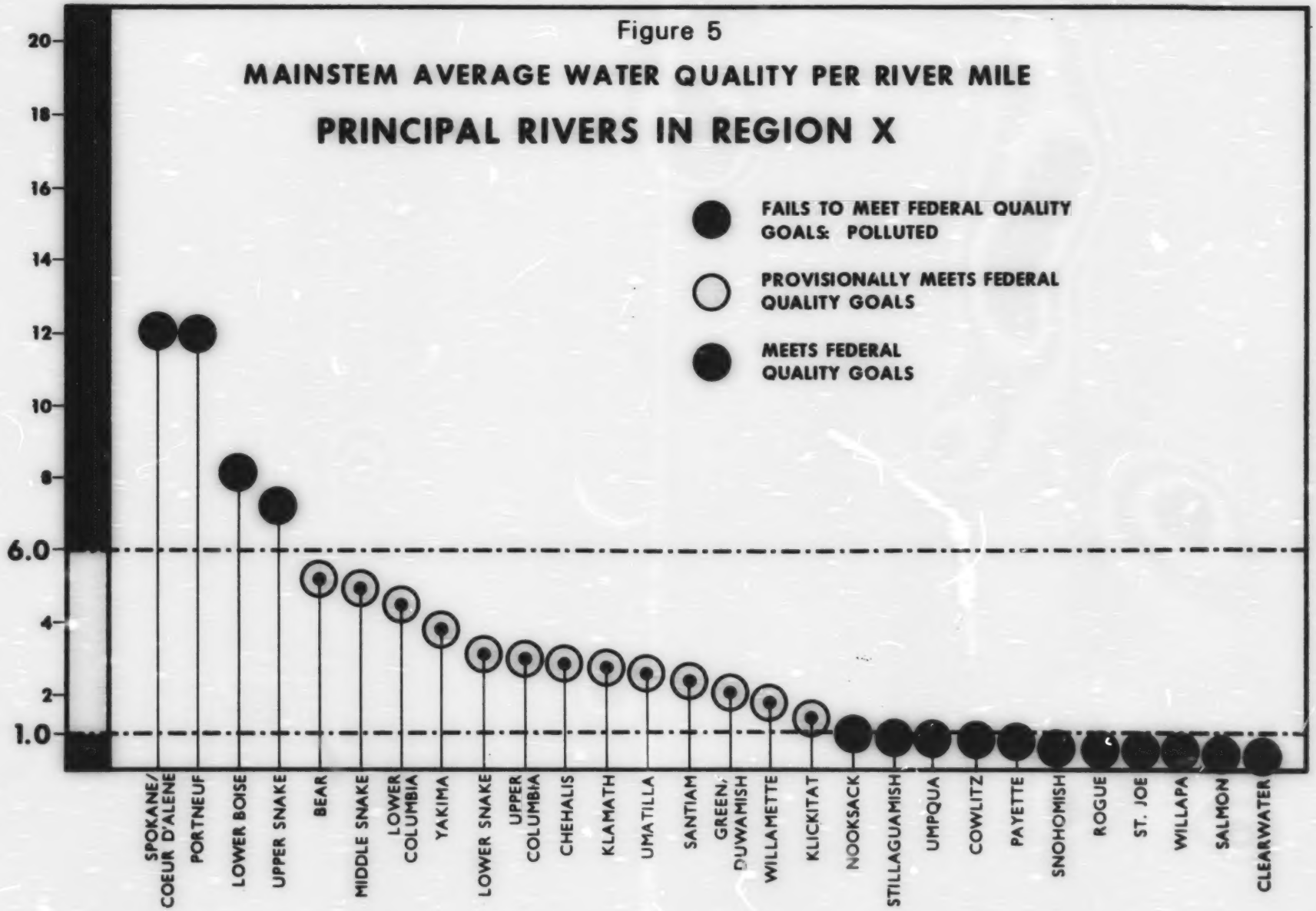
The graphs of water quality indices are divided into three segments that reflect professional judgment as to the significance of the values. An index number greater than 6.0 is considered to be characteristic of streams or stream segments that do not meet the goals of the Federal

1/ EPA R3.033 Ecological Research Series, Water Quality Criteria 1972, U.S. Government Printing Office, March 1973.

Figure 5

## MAINSTEM AVERAGE WATER QUALITY PER RIVER MILE

## PRINCIPAL RIVERS IN REGION X



Water Pollution Control Act--bodies of water that are, based upon federal criteria, definitely polluted. An index number less than 1.0 is considered to be equivalent to unpolluted natural conditions. The area between 1.0 and 6.0, where most Pacific Northwest rivers fall, is generally consistent with the goals of the Federal Water Pollution Control Act, but with local or seasonal deviations.

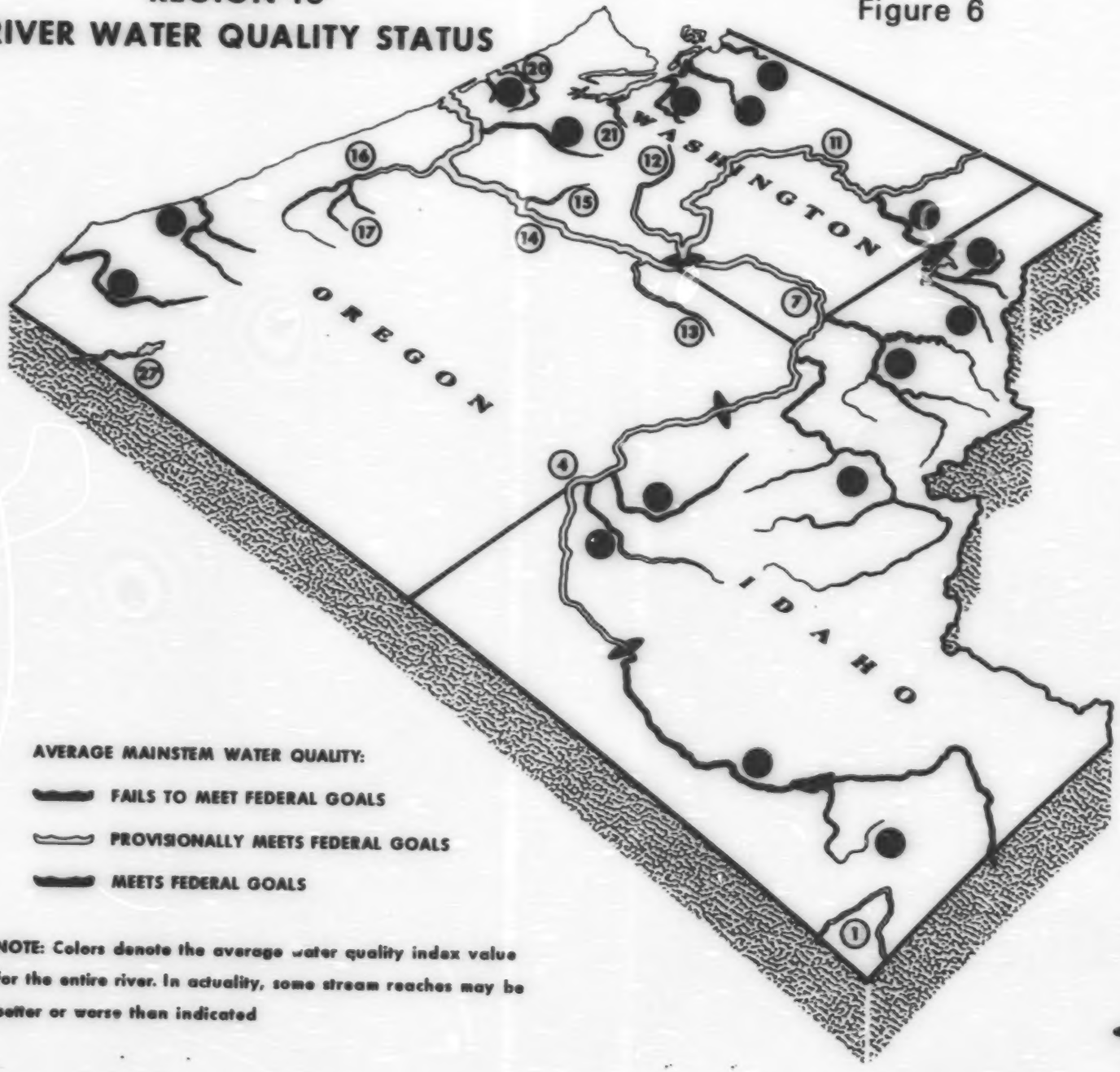
The water quality index is used in this report for the purpose of comparing twenty-eight Pacific Northwest rivers within the States of Idaho, Oregon, and Washington. In each major river discussed in this section, the WQI is a summation of the significant individual stream segments that make up each river. The resultant river WQI is the weighted average of the individual WQIs within the river and may not reflect local pollution problems existing in some of the individual segments. For ease of presentation, colors on Figure 6 represent the average WQI range for the mainstem of each river; however, the actual WQI could change throughout each river segment.

As Figures 5 and 6 indicate, all but four of the major rivers of the Pacific Northwest generally meet the goals of the Federal Water Pollution Control Act; however, three rivers have index numbers that are perilously close to the 6.0 that indicates unequivocal pollution. It is apparent that the more arid and agriculture oriented parts of the Region have the worst pollution. The Upper Snake River and its tributaries--the Boise and Portneuf Rivers--are three of the four worst polluted rivers in the Region. The fourth river, Spokane/Coeur d'Alene, is located in an intensive mining and smelting area. Other streams that flow through major agriculture areas include the Middle Snake, Yakima, and Bear Rivers. These streams have higher index numbers than most of the remaining rivers within the Region. Major coastal, major mountain, and Puget Sound rivers, with a few exceptions, have relatively good water quality. The exceptions, Green/Duwamish and Chehalis Rivers, flow through major populated areas.

The most prevalent of the eleven classes of pollution (see Table 5 below) that make up the index are excessive bacterial populations which indicate the possible presence of disease-related bacteria and viruses (Pathogenic indicators), excessive concentrations of phosphorus and nitrogen which have been documented to be the major nutrients responsible for eutrophication in the Region (Trophic potential), and excessive presence of suspended materials or oil and grease (Aesthetics). Each of these three classes of pollution was found to occur in half or more of the twenty-eight Pacific Northwest rivers that were analyzed for this report; and each at this time appears to be associated predominantly with runoff rather than waste discharges. High concentrations of toxic organic compounds such as pesticides, dissolved oxygen deficiencies, and elevated temperatures are also common. (The latter two are associated predominantly with reservoir conditions.) Supersaturation of dissolved gasses, heavy metals in toxic concentrations (toxic inorganics), salinity (dissolved minerals), and excessive acidity are also found, though they are rarer forms of pollution in the Pacific Northwest. No excessive concentrations of radioactivity were measured or suspected in the Northwest waters.

# REGION 10
# RIVER WATER QUALITY STATUS

Figure 6




**AVERAGE MAINSTEM WATER QUALITY:**

- FAILS TO MEET FEDERAL GOALS
- PROVISIONALLY MEETS FEDERAL GOALS
- MEETS FEDERAL GOALS

**NOTE: Colors denote the average water quality index value for the entire river. In actuality, some stream reaches may be better or worse than indicated**

**STREAMS/REACHES**

1. BEAR RIVER
2. UPPER SNAKE RIVER
3. PORTNEUF RIVER
4. MIDDLE SNAKE RIVER
5. BOISE RIVER
6. PAYETTE RIVER
7. LOWER SNAKE RIVER
8. ST. JOE RIVER
9. COEUR D'ALENE RIVER
10. SPOKANE RIVER
11. UPPER COLUMBIA RIVER
12. YAKIMA RIVER
13. UMATILLA RIVER
14. LOWER COLUMBIA RIVER
15. KLICKITAT RIVER
16. WILLAMETTE RIVER
17. SANTIAM RIVER
18. COWLITZ RIVER
19. WILLAPA RIVER
20. CHEHALIS RIVER
21. GREEN/DUWAMISH RIVER
22. SNOHOMISH RIVER
23. STILLAGUAMISH RIVER
24. NOOKSACK RIVER
25. UMPQUA RIVER
26. ROGUE RIVER
27. KLAMATH RIVER
28. CLEARWATER RIVER
29. SALMON RIVER

**Selected stream/reach limits**

Table 5 - Percent of Regional Rivers
Not Meeting Water Quality Criteria

| Class | Criteria Group | Idaho | Oregon | Washington | Regional Avg. |
|---|---|---|---|---|---|
| 1 | Bacteria | 50% | 86% | 77% | 71% |
| 2 | Trophic potential | 88% | 86% | 38% | 64% |
| 3 | Aesthetics | 38% | 71% | 46% | 50% |
| 4 | Toxic organics | 25% | 71% | 38% | 43% |
| 5 | Dissolved oxygen | 38% | 29% | 31% | 32% |
| 6 | Temperature | 25% | 29% | 15% | 21% |
| 7 | Dissolved gasses | - | 14% | 23% | 14% |
| 8 | Toxic inorganics | 25% | - | 15% | 14% |
| 9 | Dissolved minerals | 50% | 14% | - | 18% |
| 10 | Acidity/Alkalinity | 13% | - | - | 4% |
| 11 | Radioactivity | - | - | - | - |

A pattern of change appears to be evolving in the nature of Pacific Northwest water pollution; though variations in flow, climate, and monitoring make any conclusions with respect to short term trends provisional. As seen on Table 6 below, those pollutants that have historically been associated with waste discharges--bacteria, nutrients, acidity, oxygen consuming substances, heavy metals from industrial operations--appear to be progressively less prevalent in Regional rivers. Conversely, pollutants that are associated with runoff, fallout, intense land use, reservoirs, and in-stream chemical reactions--toxic organic compounds, dissolved gasses, total dissolved solids--would appear to be increasing in prevalence and concentrations. Some of this apparent deterioration may be due to improved analytical capability in recent years.

Table 6 - Water Quality Trends of Regional Rivers

| Class | Criteria Group | Improving* | Deteriorating* | No Change* |
|---|---|---|---|---|
| 1 | Bacteria | 21% | 11% | 68% |
| 2 | Trophic potential | 11% | 7% | 82% |
| 3 | Aesthetic | 7% | 7% | 86% |
| 4 | Toxic organics | - | 25% | - |
| 5 | Dissolved oxygen | 7% | 7% | 86% |
| 6 | Temperature | - | - | - |
| 7 | Dissolved gasses | - | 7% | - |
| 8 | Toxic inorganics | 4% | - | - |
| 9 | Dissolved minerals | 4% | 7% | 89% |
| 10 | Acidity/Alkalinity | 4% | - | - |

* Figure represents the precent of streams within the three states which are improving or deteriorating by criteria group. One stream may be improving with respect to one criteria group and deteriorating in another; therefore, it would be included in each listing. If 7% of the rivers in one criteria group are improving and 7% are deteriorating in the same group, then 86% experience no chan at all.

The impression that may be derived from the data is that contemporary water pollution strategies based on waste treatment are proving effective with traditional pollutant sources but the more complex and resistant kinds of pollution that stem from intensive use of land and water may be offsetting some part of that improvement.

## WATER QUALITY IN IDAHO

A review of nine major Idaho rivers (Figure 7)--the mainstem river proper, not the entire drainage system--reveals a water quality pattern that diverges sharply from that for the mainstem stream of all Pacific Northwest drainage basins. A disproportionate share of the Pacific Northwest's water pollution is concentrated in the streams of the State of Idaho.

Four of the nine rivers--the Coeur d'Alene, Portneuf, Boise, and Upper Snake--are, by virtue of an index number greater than 6.0, probably too polluted to meet federal goals for water quality sufficient for propagation of native fish and for unrestricted recreational use. Each of the four has a pollution number greater than that of the basin that it drains, indicating that the quality of the mainstem river is inferior to that of its tributaries. Two rivers (the Bear and the middle and lower reaches of the Snake) reveal an index number consistent with significant intermittent or local departure from the federal goals. The St. Joe, Salmon, Clearwater, and Payette are the only major Idaho rivers considered which presently meet federal goals (many tributaries, however, are virtually pristine).

The most common class of pollution of the Idaho rivers that were analyzed is an excessive presence of bacteria and turbidity, a feature common to all of the rivers in the southern portion of the State. Those southern rivers also display a uniform pattern of phosphorus concentrations sufficient to result in nuisance growths of algae and water weeds. Dissolved oxygen deficiencies are experienced in the Snake River reservoirs as well as the Portneuf and Boise Rivers. Excessive mineral salts occur in the waters of the Bear as a consequence of intense use in irrigation and natural salt deposits.

More serious water quality conditions that result in direct toxicity to aquatic life are to be found in the Lower Snake in the form of dissolved gas supersaturation induced by flow over dam spillways, in the Coeur d'Alene and Upper Snake's heavy metals concentrations, and in excessive pesticides concentrations of the Bear, Upper Snake, and Boise Rivers.

The picture of Idaho water quality that emerges from the index and from consideration of particular pollutants and stream reaches is not encouraging. The combination of intense use and management pressures in the semi-arid southern portion of the State with the effects of the mining operations heavy metals on its northern waters provides a level of water quality stress that would appear to be far greater than that encountered by neighboring Pacific Northwest states.

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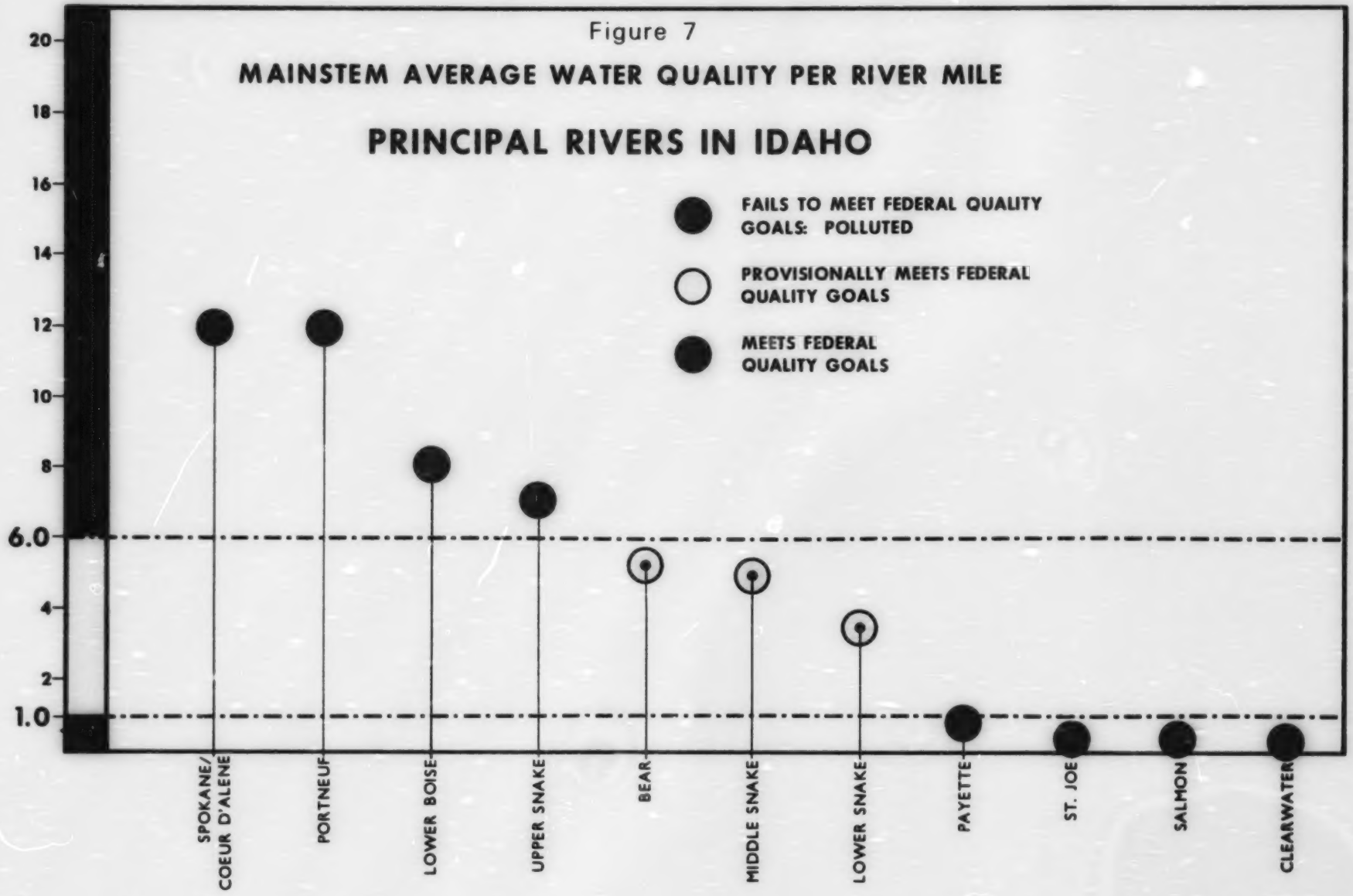
Figure 7


MAINSTEM AVERAGE WATER QUALITY PER RIVER MILE
PRINCIPAL RIVERS IN IDAHO
FAILS TO MEET FEDERAL QUALITY GOALS: POLLUTED
PROVISIONALLY MEETS FEDERAL QUALITY GOALS
MEETS FEDERAL QUALITY GOALS
20
18
16
14
12
10
8
6.0
4
2
1.0
SPOKANE/ COEUR D'ALENE
PORTNEUF
LOWER BOISE
UPPER SNAKE
BEAR
MIDDLE SNAKE
LOWER SNAKE
PAYETTE
ST. JOE
SALMON
CLEARWATER

## POLLUTANT SOURCES: SUSPENDED SOLIDS

Suspended solid materials constitute the most abundant pollutant in the waters of the Pacific Northwest. An average of 260 million pounds per day--70 million originating in the Snake River system--are carried to the mouth of the Columbia, though the volume varies enormously with streamflow, precipitation, and reservoir operating patterns.

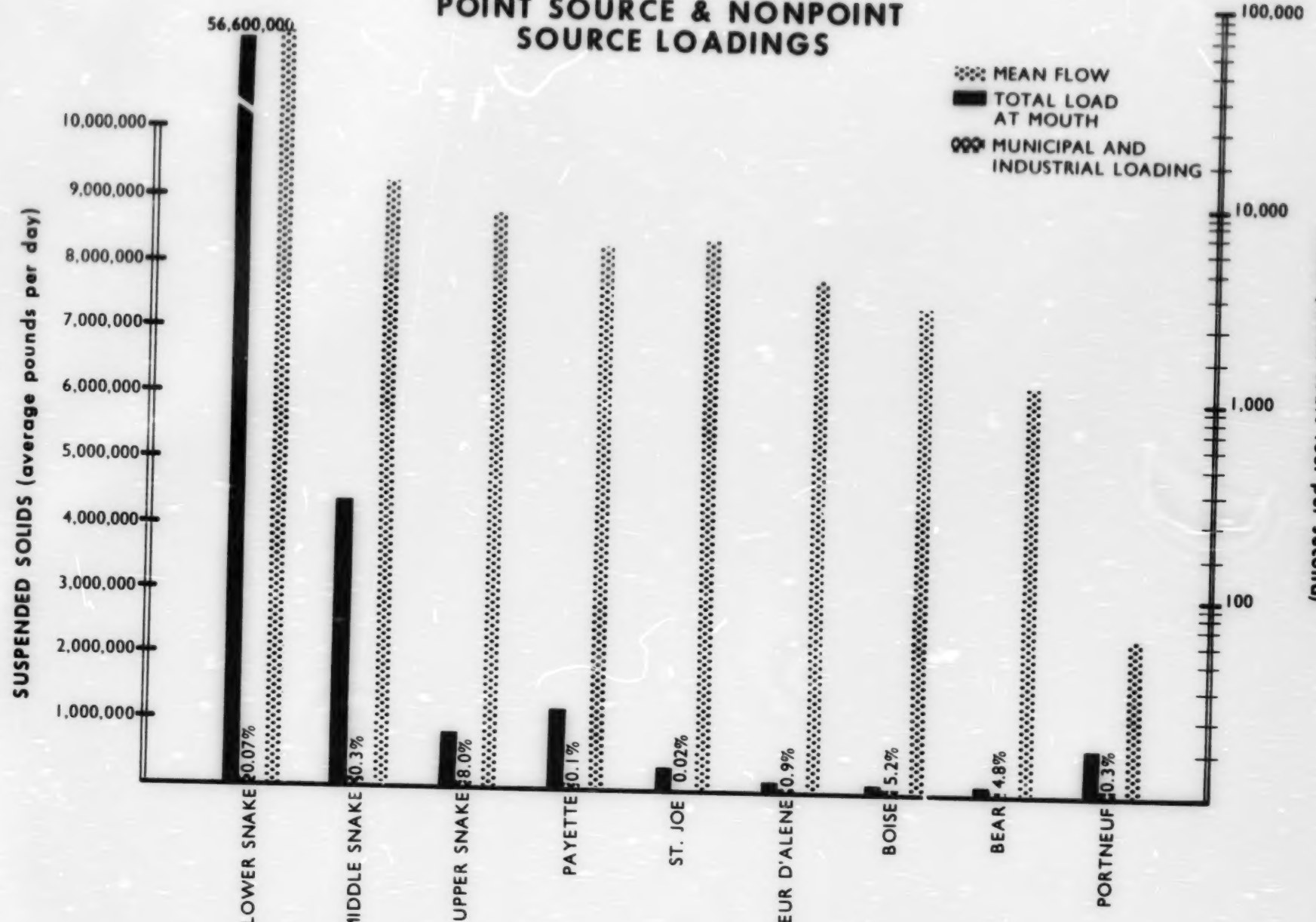
Suspended solids are not a single pollutant, but a general class of materials that are characterized by having a specific gravity close to 1.0. Thus they include both inert materials and organic matter--some of it, such as algae, living organisms. The specific polluting mechanisms of suspended solids are reduction of light penetration, discoloration, and with gradual settling, silting of fish spawning gravels and the other ill effects of sediments. In addition to the specific effects of this general category of pollutant, suspended solids are indicators of other potential for pollution: the organic fraction is degradable, so a source of oxygen demand; and suspended materials are carriers of both nutrients (primarily phosphorus) and of toxic materials which may ultimately be released.

There is a pattern to the production of suspended solids in Idaho rivers. The mean concentration of suspended solids in the rivers studied, as indicated by average flows and solids weights in Figure 8, is less than 200 parts per million parts of water. But while the average values for the northernmost rivers--the Coeur d'Alene, the Payette, and the St. Joe--are less than half of that value, the values for the components of the Snake River and its tributaries are somewhat higher. The major solids loadings to Idaho's waters occur in the more agriculturally developed portions of the State.

Direct industrial and municipal waste discharges are an insignificant source of the pollutant. Aggregated waste discharges of suspended solids from point sources amounts to only 0.2% of the total suspended solids for all of the waterbodies studied--this in spite of an aggregation technique that significantly over estimates discharge-related solids loading. (No allowance is made for settling or decomposition.) There is, however, a chain of biological reaction through which the effect of such discharges with respect to the total quantity of solids may be amplified. Given the proper conditions, nutrient phosphorus from waste discharges can promote algal growth that is roughly 120 times the dry weight of the available phosphorus, with an even greater expansion of volume. Waste discharges, then, may be a substantial indirect source of suspended solids under specialized circumstances.

Figure 8

# RIVERS IN IDAHO
## POINT SOURCE & NONPOINT SOURCE LOADINGS



## POLLUTANT SOURCES: BIOCHEMICAL OXYGEN DEMAND

Biochemical Oxygen Demand (BOD)--the rate at which oxygen is consumed by populations of aquatic bacteria that utilize dissolved organic matter as nutrients--has been used as the prime measure of a stream's pollution for the better part of a century.

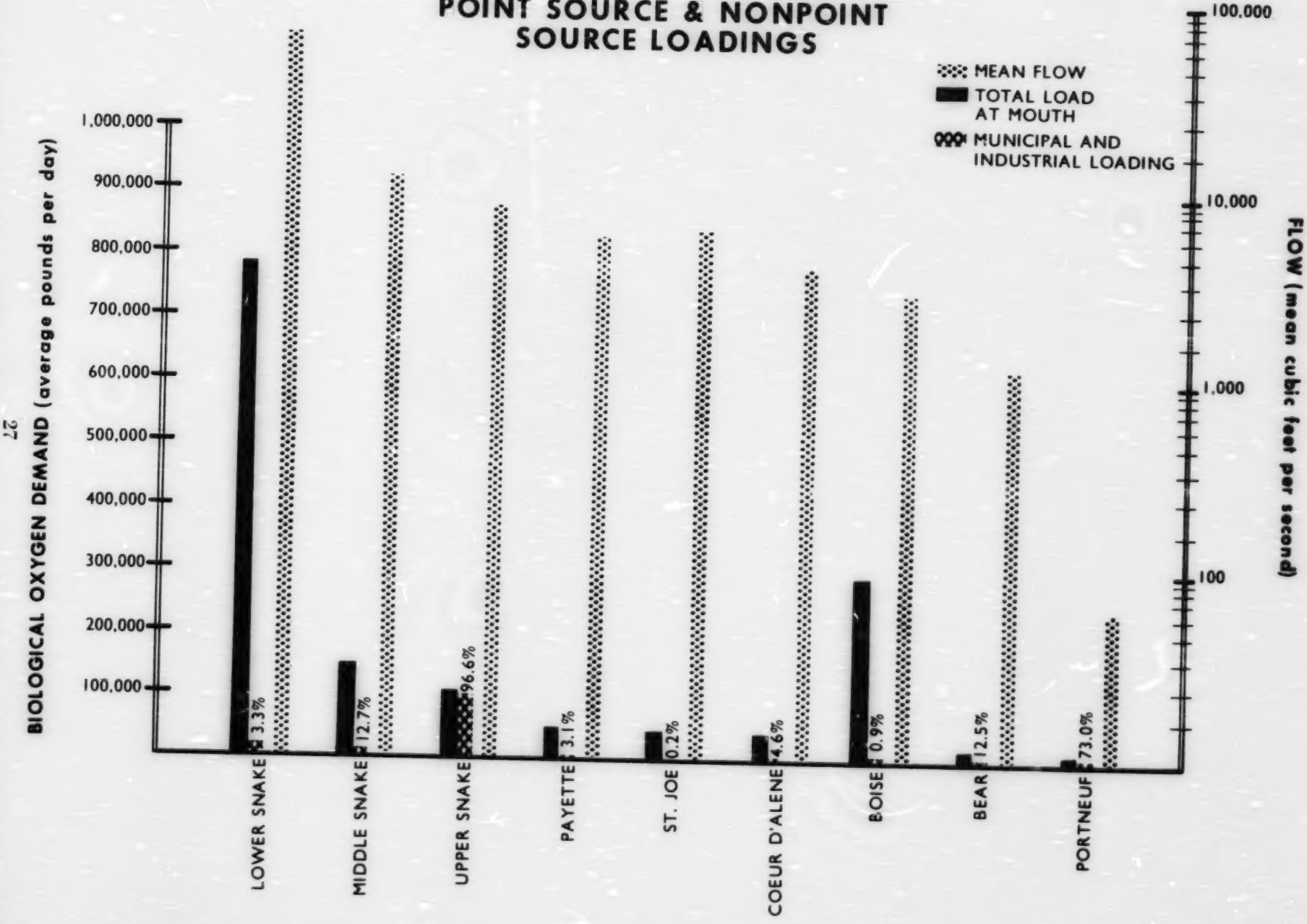
When exerted at a rate in excess of the rate of reoxygenation, biochemical oxygen demand may reduce the amount of oxygen that is dissolved in water sufficiently to change the composition of aquatic life forms in the area of the stream that is affected, as well as to reduce its level of biologic activity. The pollutant also serves as a measure of the potential organic enrichment of a stream, enrichment that may support regrowth of bacterial populations or contribute through decompositon processes to nuisance proliferation of algae and other water plants.

As the graph in Figure 9 demonstrates, there is a significant variation in the BOD levels of the nine Idaho streams that were studied. The average BOD concentration for all nine rivers was just above three parts per million at the mouth. But for the Boise River the concentration was above twenty parts per million; and for the Portneuf, it was greater than thirty-five parts per million (i.e. somewhat above the allowable level for treated sewage under the Federal effluent limitations). The Bear River, too, demonstrated elevated BOD concentrations, about six parts per million. Conversely, the three northern Idaho rivers--the Coeur d'Alene, St. Joe, and Payette--displayed uniformly low levels of oxygen demand, below two parts per million in all cases. These levels are approaching what can be considered background levels for good quality streams.

It is noteworthy, too, that there are significant differences in the sources of biochemical oxygen demand. The Portneuf and Upper Snake appear to derive the majority of their oxygen demand from point sources --discharges of municipal and industrial waste. (The analytical method --sum of discharges over the length of the stream related to gross BOD exerted at the mouth--undoubtedly exaggerates the affect of such discharges, since it fails to allow for in-stream stabilization: for BOD is a reaction rate that is self-eliminating.) That situation is consistent with the conventional wisdom, under which BOD has generally been viewed largely as a measure of the influence of such wastes. But on the Middle Snake and the Bear, waste discharges account for only about 10% of total BOD at the mouth--just about the average for all nine rivers. And for the other five rivers studied, point sources can account for less than 5% of total biochemical oxygen demand. Clearly, at the level of waste treatment achieved in Idaho, BOD production in at least some cases is analogous with that of suspended solids, with runoff and other natural mechanisms outweighing waste discharges in the transport of degradable organic materials to streams.

Figure 9

# RIVERS IN IDAHO
## POINT SOURCE & NONPOINT SOURCE LOADINGS



## POLLUTANT SOURCES: TOTAL PHOSPHORUS

Phosphorus is present in Idaho streams in minute amounts--an average load of about 26,000 pounds a day at the mouth of the Snake, as contrasted to 70 million pounds of suspended solids or the 900,000 pounds of oxygen demand created by dissolved organic matter. Yet the amount is sufficient that phosphorus may be regarded as one of the more significant pollutants in Idaho waters.

Phosphorus is not in itself a pollutant. Rather, it is the ability of phosphorus, as the critical nutrient, to support growth of nuisance levels of aquatic plants that makes it a potential problem. The approximate balance of the major chemical components of algae and other water plants is 106 parts carbon, 16 parts nitrogen, 1 part phosphorus. Since some aquatic plants can draw both carbon and nitrogen from the atmosphere, the effective limit of plant populations is often dictated by the amount of phosphorus dissolved in water; and each unit of phosphorus may trigger more than 120 times its weight in plant growth. The matter is by no means so simple as the above would make it seem. Trace nutrients and sunlight are also necessary for plant growth; and the form in which phosphorus occurs has a prime influence on its nutrient effect. Where dissolved phosphorus is immediately available as a nutrient, organically bound phosphorus becomes available gradually through decomposition processes, and soil bound phosphorus may never be available to plants unless released into the water column through chemical and bacteriological processes which occur under anerobic bottom conditions.

The pollutional aspects of excessive biological activity that stems from high nutrient levels are diverse. To some degree they may be merely aesthetic--stream discoloration and presence of clumped, floating water weeds--but more fundamental ecological alterations may also be involved. Because of the photosynthetic respiratory cycle (plants give off oxygen in sunlight, consume it at night) variations in daytime and nighttime dissolved oxygen concentrations may occur that produce extreme stress on fish life. Similar diurnal variations in acidity and alkalinity may occur. Light penetration is reduced. Decay of dead material that settles out in lakes or reservoirs may produce oxygen deficiencies. The enriched environment is favorable to regrowth of bacteria that may in some cases be harmful. Loss of species balance in fish populations follows from the specialization of the organisms that fish feed upon. The taste and odor of water may be altered disagreeably, and carrying capacity of pipes and channels may be reduced.

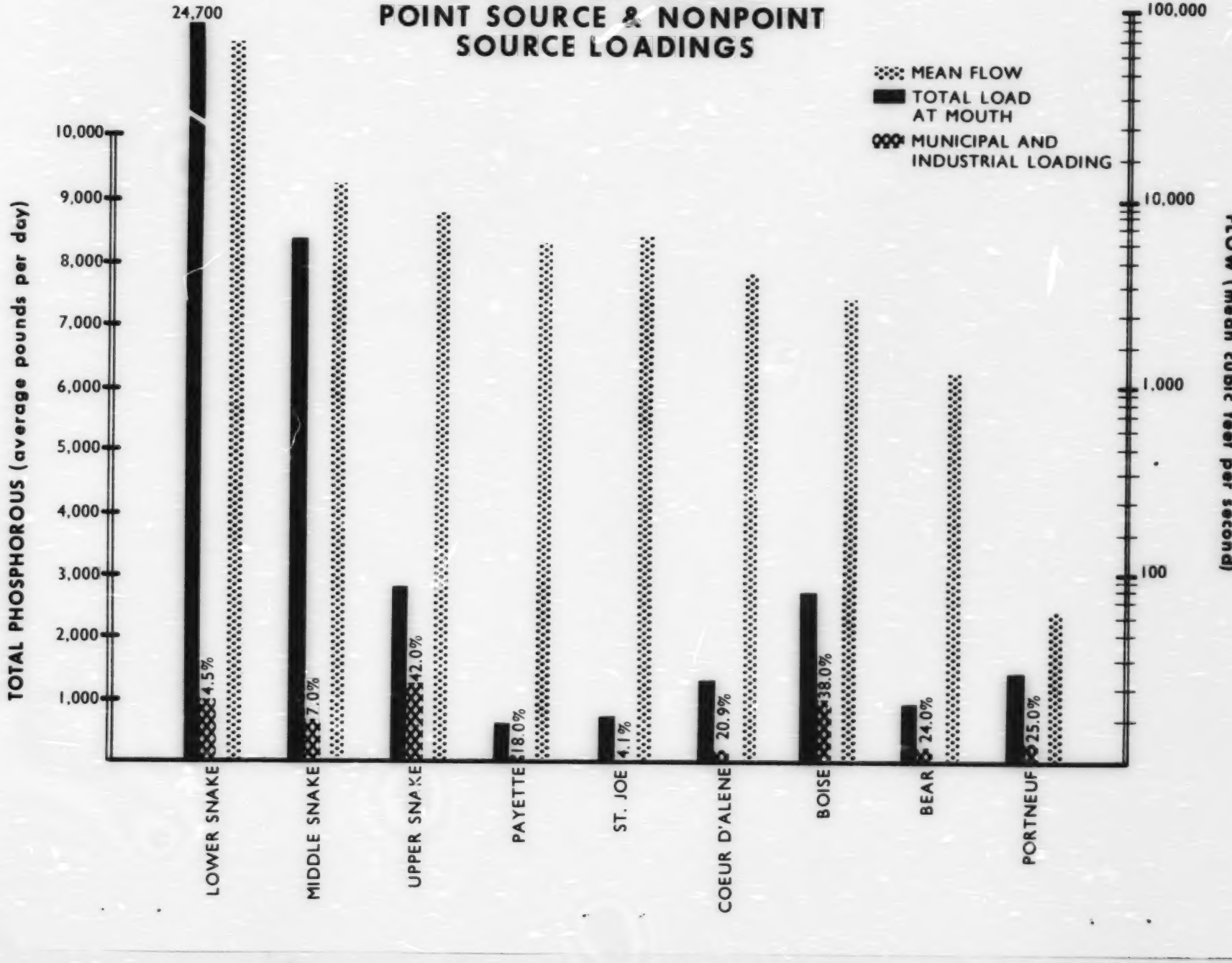
Most of the Idaho rivers that were evaluated were extremely rich in phosphorus as can be seen on Figure 10. There is a rule of thumb that holds that, with the normal distribution of phosphorus forms, a concentration of .05 parts or more per million parts of water can result in nuisance algae growth. All of the southern Idaho streams as well as the Coeur d'Alene exceed that level.

Municipal and industrial waste discharges are not in the aggregate a significant source of phosphorus. They account, in total, for about 10% of the phosphorus loading of the nine streams evaluated. But for several reasons those discharges are a more significant contributant to pollution potential than their gross amount would suggest. As Figure 10 demonstrates, waste discharges provide an above average share of phosphorus in precisely those streams in which concentrations are highest, the Portneuf, the Bear, and the Boise. Perhaps more significant than the distribution of waste-originating phosphorus concentrations is their form. The accelerated decomposition of organic matter that occurs in waste treatment results in a discharge whose phosphorus content is largely in solution, thus immediately available as a growth-triggering nutrient; while much, if not most, of the phosphorus originating with runoff is soil bound and may not be available to algae. Thus both the form and the distribution of that phosphorus that occurs in discharged wastes tend to give it a disproportionate pollutional effect.

Figure 10

# RIVERS IN IDAHO

## POINT SOURCE & NONPOINT SOURCE LOADINGS



## WATER POLLUTION TRENDS

Figure 11 depicts the presence and trends of eleven broad classes of water pollution as they are revealed by the monitoring record for major Idaho rivers in the period 1971 through 1975.

A blue box indicates that measurements for the indicated class of pollutant produced no evidence of a violation of Federal criteria for water suitable for fish, wildlife, and recreation. Yellow and red boxes indicate respectively that there were relative minor and major violations of the criterion. The color determination takes into account the frequency and magnitude of the violation as well as the water quality sampling frequency. An upward pointing arrow within the box indicates measurements that show either that the concentration of the particular pollutant is rising or that the frequency of criterion violation is increasing--that is, that the propensity for pollution to occur is rising. (A downward pointing arrow would indicate a decline in the propensity for pollution.) A circle within the box indicates a judgment based on knowledge of pollutant sources rather than actual water quality measurements.

As Figure 11 demonstrates, the most common criteria violations in Idaho are those derived from bacteria counts and excessive nutrient concentrations (Trophic). Violation of aesthetic criteria--those for suspended materials, light penetration, oil and grease--appear to be common mainly in southern Idaho streams that are put to heavy irrigation use. Toxic concentrations of heavy metals are present in both the Coeur d'Alene and the Upper Snake. Supersaturation of dissolved gasses is a serious source of pollution below Lower Snake River reservior; and dissolved oxygen deficiencies occur in reservoirs of the upper river. Toxic organic compounds appear to be present in the form of pesticides in the Bear, Upper Snake, and Boise Rivers.

In total, of ninety-nine opportunities for pollution (eleven pollutant classes, nine evaluated rivers), forty-two are realized. In five cases the propensity for pollution appears to be increasing.

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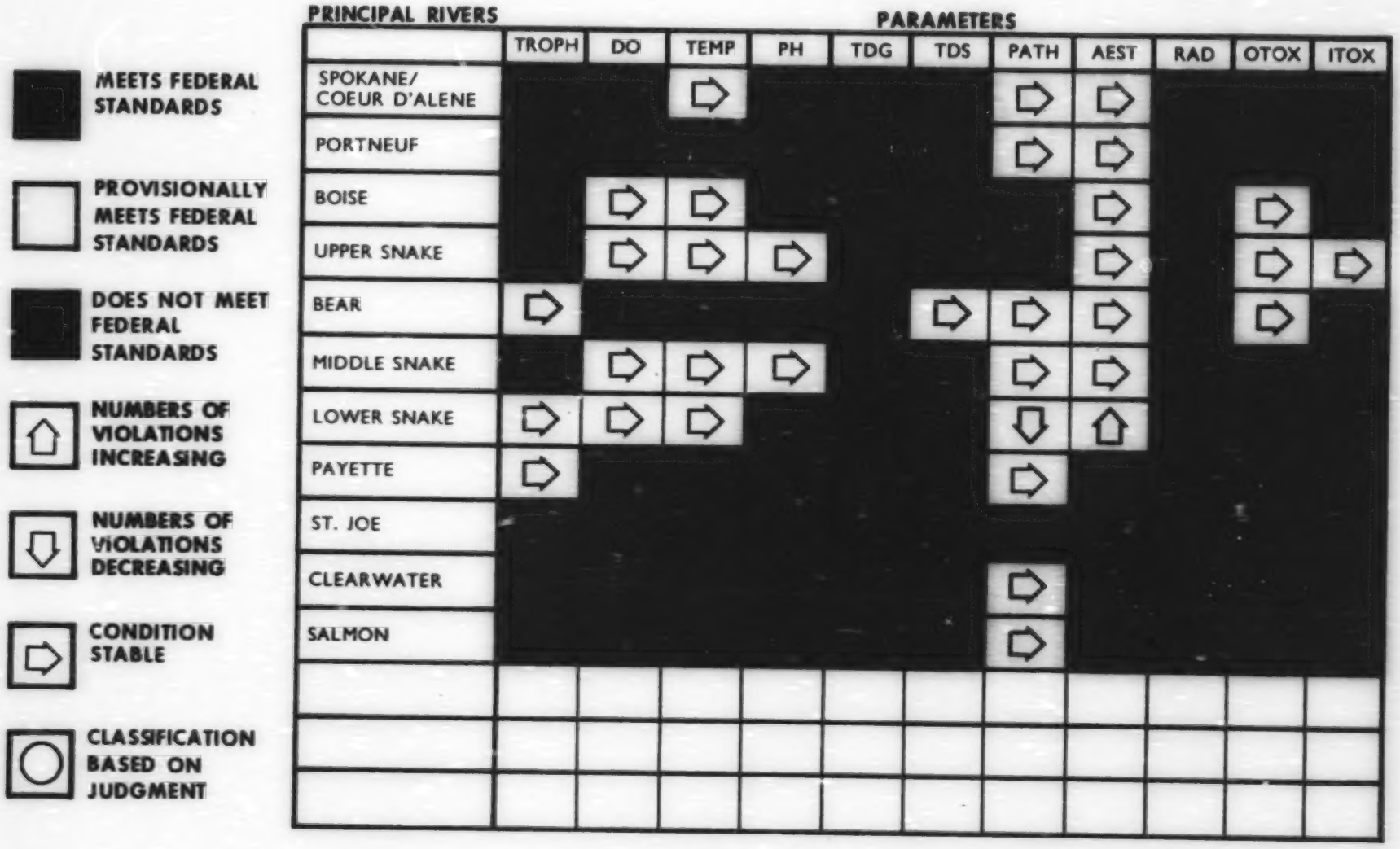
Figure 11

# RIVERS IN IDAHO

## FEDERAL CRITERIA VIOLATIONS



## NEAR TERM OUTLOOK

Consideration of the nature, location, sources, and trends of water pollution in the State of Idaho must lead to the conclusion that little significant improvement can be anticipated in the major rivers in the next three to five years.

The assessment is almost inescapable. With exceptions, the current water quality problems of Idaho do not stem primarily from point source waste discharges, which in the past were the primary focus of water pollution abatement programs, but from intensive use, from water management and reservoir conditions, and from runoff. Waste treatment is already well advanced (though by no means complete) in the State. Measures to reduce the polluting influence of runoff, stream regulation, and irrigation largely remain to be defined. And as such definitions occur and are adopted in the State, it must be anticipated that they will be offset to some degree by sheer growth in the scale of human activities and by the complications posed by proliferation of toxic organic compounds. There will, in short, be no convenient technological solution like waste treatment with which to deal with the bulk of remaining and emerging water pollution problems of Idaho.

Little aggregate improvement can be anticipated from extension of municipal and industrial (M&I) waste treatment because (as the review of pollutant sources indicates) M&I point sources of waste are a minor factor in Idaho's present water quality situation. It is true that point sources continue to contribute significantly to BOD in some watercourses; but as Figure 11 indicates, dissolved oxygen deficiencies (which can be remedied by BOD reduction) are limited mainly to the Snake River--and there they are in most cases a function of reservoir conditions rather than BOD per se. Similarly, point sources are responsible for significant amounts of phosphorus in some cases; but the total elimination of such sources alone would not reduce phosphorus concentrations below the nuisance triggering level in every instance. Improvement in the degree of waste treatment may help to reduce the magnitude of such problems, as well as the prevalence of excess bacteria, but it cannot be expected to eliminate them.

Recognition of the limited marginal effect of M&I waste treatment, the significance of non-point sources of pollution, and the difficulties of of dealing with such sources, then, leads to the conlcusion that no major change in Idaho's water quality is in the offing in the near term. That is not, however, a totally pessimistic perception. The fact remains that, while Idaho accounts for a large share of the Pacific Northwest's water pollution, that pollution is concentrated on few--and rather small--stream segments. To sustain the quality of the remaining rivers, and to effectuate some improvements in the sorely polluted ones, would certainly constitute a worthwhile achievement--particularly in view of the rapid rate of population increase the State has experienced since 1970 and taking into account the major improvements in water quality achieved in the Snake River system since the early nineteen-sixties.